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WHAT ARE THE DETERMINANTS OF MREL-ELIGIBLE DEBT YIELDS?

EVIDENCE FROM THE EU BANKING SECTOR

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ABSTRACT

We examine the risk sensitiveness of minimum requirement for own funds and eligible liabilities (MREL)-eligible debt yields in a sample of 63 European banking groups during the period 2009Q3–2019Q2 in 14 European countries. We conclude that MREL-eligible debt is risk sensitive, as investors closely monitor indicators related to individual banks, issuance characteristics, market risk variables and the features of the banking system potentially affecting MREL-eligible debt default risk. Our results, however, are not homogeneous across banks, time periods or types of debt product. In particular, we find evidence of higher risk sensitiveness in other systemically important institutions and non-systemic banks. We also identify higher levels of risk sensitiveness after the entry into force of the first Bank Recovery and Resolution Directive. However, we observe less risk sensitiveness during periods when targeted longer term refinancing operations were under way, in particular regarding bank and market risk variables. Our model also suggests that investors closely monitor senior non-preferred issuers. This means that the market discipline that has traditionally been exercised through subordinated debt is currently exercised through senior non-preferred issuances. Credit ratings are seen as a high-credibility tool, helping investors in the market to better exercise market discipline.

KEYWORDS

MREL, debt yield, market discipline, bank risk, Banking Package, BRRD, European Banking Union.

1. Introduction

The global financial crisis (GFC) of 2007–2008 provoked a generalised episode of financial and banking distress that led governments to bail out distressed banks. The use of public funds entailed a deterioration in macroeconomic indicators (e.g. a sharp increase in debt to gross domestic product (GDP) ratios) and confirmed the existence of the well-known 'too big to fail' (TBTF) problem previously identified in financial literature. The regulatory response after the GFC aimed to leaving behind the concept of TBTF by implementing specific resolution tools and ensuring that unsecured creditors absorb losses in order to guarantee the good functioning and continuity of critical banking functions.

In a scenario in which bail-in mechanisms are more likely than before the GFC, investors in eligible debt for bail-in purposes should monitor banks' indicators and fundamentals. To the best of our knowledge, hardly any study has tackled the determinants of the yield on eligible debt for bail-in purposes in the European banking sector. Some exceptions are the papers by Crespi et al. (2018), with a sample limited to Italian banks; Boss and Scheicher (2002), which includes corporate bonds from various industries; and Annaert et al. (2013), which focuses on the determinants of banks' credit default swap (CDS) spreads. However, none of these studies considers all kinds of eligible debt for bail-in separately or includes a detailed and complete sample of all bank issuances of eligible debt products across Europe.

In this study, our objective is to test the risk sensitiveness of all kinds of minimum requirement for own funds and eligible liabilities (MREL)-eligible debt yields in a sample of 63 European banking groups during the period 2009Q3–2019Q2 in 14 European countries. Our paper contributes to the existing literature in assessing the risk sensitiveness of bank bond yields from different perspectives. First, from a bank-level characteristics perspective. Second, in terms of types of debt (i.e. subordinated, senior non-preferred, senior unsecured, etc.). Third, with regard to the characteristics of the country of issuance; and, fourth, depending on the specific period of time (before and after the first Bank Recovery and Resolution Directive (BRRD I)).

The different model specifications defined as part of our empirical approach aim to provide answers to specific research questions. First, do investors in debt products that bear higher bail-in risk (i.e. subordinated creditors) respond more actively to changes in issuers' risk characteristics? Second, does the empirical model appear to have greater explanatory power for systemic institutions and does the difference in risk sensitiveness between systemic and non-systemic institutions support the existence of the TBTF subsidy? Third, does risk sensitiveness during the different periods (i.e. before and after the entry into force of BRRD I) confirm the market credibility of the resolution regimes and the effectiveness of the EU resolution framework? Fourth, does the model have greater explanatory power for lower ratings scenarios (i.e. riskier issuers)? Fifth, does the model have greater explanatory power for senior non-preferred debt than for subordinated debt? This could emerge as proof that the market discipline traditionally exercised through subordinated debt is now exercised through senior non-preferred debt. Additional specifications of the model allow us to assess the effect of unconventional monetary policies on risk sensitiveness, to check if periods of implementation of targeted longer-term refinancing operations (TLTROs) are associated with lower risk perception on the part of investors.

The rest of the paper is organised as follows. Section 2 reviews the regulatory framework for EU banks, with a particular focus on the completion of the resolution framework with the entry into force of BRRD II[1] on 27 June 2019. Section 3 provides an overview of the existing literature on the determinants of bank funding costs and on market discipline associated with subordinated debt. Section 4 describes the methodological approach implemented in order to assess the risk-sensitivity of MREL-eligible debt yields, with a description of the breakdown of the sample and the empirical model, as well as the variables used. Section 5 presents the empirical results and, finally, Section 6 concludes.

[1] Directive (EU) 2019/879 of the European Parliament and of the Council of 20 May 2019 amending Directive 2014/59/EU as regards the loss-absorbing and recapitalisation capacity of credit institutions and investment firms and Directive 98/26/EC. OJ L 150, 7.6.2019, p. 296–344.

2. Regulatory framework

After the GFC, European policymakers issued a common set of rules aimed at strengthening the EU banking sector and mitigating the consequences of both financial fragmentation in the European banking sector and the bank–sovereign nexus. The project of the Banking Union was composed of three main pillars: (i) the Single Supervisory Mechanism, (ii) the Single Resolution Mechanism and (iii) the European Deposit Insurance Scheme. The rules for the appropriate functioning of these three pillars were translated into common directives and regulations that the EU Member States were to transpose into their national legislation. In particular, the common rules are set out in the fourth Capital Requirements Directive and the first Capital Requirements Regulation, approved in 2013; in the Deposit Guarantee Scheme Directive, approved in 2014, which ensures depositor protection and represents a preliminary step towards a common depositor protection scheme in the EU (however, such a scheme does not exist yet, as deposit guarantee schemes still remain national); and BRRD I, approved in 2014 and which entered into force in 1 January 2015. Finally, the BRRD II was published on 7 June 2019 and entered into force on 27 June 2019. Among other changes, it introduced a total loss-absorbing capacity requirement for global systemically important institutions (G-SIIs), incorporating into EU Level 1 legislation the Financial Stability Board standards. After years of policy debate, BRRD II also clarified the subordination requirement for resolution entities (i.e. the amount of the MREL requirement that should be fulfilled with subordinated instruments, those that do not rank *pari passu* with other liabilities). In this respect, it introduced a new category of banks labelled 'top tier', those with consolidated assets amounting to more than EUR 100 billion. Thus, the subordination requirement for G-SIIs and top-tier banks was to be (i) the higher of 18% of total risk exposure amount (TREA) plus the combined buffer requirement and 6.75% of leverage ratio exposure for G-SIIs; (ii) the higher of 13.5% of TREA plus the combined buffer requirement and 5% of leverage ratio exposure for top-tier banks and other Pillar 1 banks (Article 12d(4), first subparagraph, of the second Single Resolution Mechanism Regulation (SRMR II)[2]).

The subordination requirement is focused on the 8% total liabilities and own funds (TLOF) target level, which can be increased up to a certain cap. For G-SIIs, top-tier banks and other Pillar 1 banks, the target level can be increased to the extent that it must not exceed the higher of (i) 8% of TLOF and (ii) the prudential formula 2 x Pillar 1 + 2 x Pillar 2 + Combined Buffer Requirements (Article 12c(7) of SRMR II). More precisely, for top-tier banks the 8% TLOF target level is capped at 27% of TREA (Article 12c(4), second subparagraph, of SRMR II), meaning that if the TLOF component results in an amount higher than 27% of TREA, the cap of 27% of TREA must be applied.

Moreover, institutions that do not qualify as G-SIIs, top-tier banks or other Pillar 1 banks are also subject to subordination requirements (Article 12c(5) of SRMR II), based on a case-by-case assessment of 'no creditor worse off' (NCWO) risk by the resolution authority. In particular, the resolution authority can impose subordination requirements on an institution that is 'reasonably likely to pose a systemic risk in the event of its failure'. Article 12c(8) of SRMR II imposes a limit on the discretion available to the resolution authorities, in terms of the proportion of entities that can at the sole discretion of the resolution authority be subject to the same requirements as G-SIIs and top-tier banks. This limit is set at 30% of the total number of all resolution entities. The regulation also includes some indications of entities that are likely to pose a systemic risk in the event of its failure, including (i) substantive impediments to the institution's resolvability, (ii) limited credibility of the institution's resolution strategy, (iii) the institution is in the top 20% of institutions with the highest Pillar 2 requirements (i.e. the amount of capital that institutions are to hold in excess of Pillar 1 capital, relating to risks not covered by Pillar 1).

[2] Regulation (EU) 2019/877 of the European Parliament and of the Council of 20 May 2019 amending Regulation (EU) No 806/2014 as regards the loss-absorbing and recapitalisation capacity of credit institutions and investment firms. OJ L 150, 7.6.2019, p. 226–252.

In conclusion, subordination requirements are now established for the European banking sector. European banks are to comply with the requirements by 1 January 2024, with a transitional period that includes two intermediate targets (a first, binding intermediate target to be met by 1 January 2022, and a second intermediate target of an informative nature by 1 January 2023).

3. Related literature

Our research is related to different strands of previous literature, all closely connected. First, it is related to the set of papers that have examined the determinants of banks' funding costs. Second, it is related to the literature that has studied market discipline through subordinated debt. Finally, our research also relies on the more recent literature on bail-in bonds.

Forming part of the first strand of literature, Babihuga and Spaltro (2014), using CDS premia to explain the factors determining bank funding costs over the period including the GFC and the euro area sovereign debt crisis, found a positive long-run relationship between funding costs and banks' balance-sheet health. Their results also reported a negative long-run relationship between funding costs and both total capital and higher quality Tier 1 capital. In a more recent study, Acharya et al. (2016) found that bonds were risk sensitive for most financial institutions in their sample during the period 1990–2012. However, this empirical finding did not hold for large institutions. This is consistent with the idea that systemically important institutions borrow at subsidised prices.

Evanoff et al. (2010) examined for US banks the determinants of subordinated debt spreads and the differences in the pricing behaviour of bank subordinated debt during the issuance period, when banks, relative to other periods, are more willing to provide additional information to the market. They ran an explanatory model of the spread (difference between the subordinated debt yield for the bank and the yield of a Treasury bond with the same time to maturity) on a vector of macroeconomic measures, a vector of the various measures of the bank's risk and a vector of other firm-specific or security-specific control variables. As expected, bank balance-sheet measures were found to significantly influence the spread. In particular, the results of this paper make it possible to conclude that banks with higher levels of non-performing loans (NPLs) and lower profits are subject to larger subordinated debt spreads.

Similarly, the results obtained by Sironi (2003) for European banks support the hypothesis that subordinated debt investors are sensitive to bank risk, except in relation to issuances by government-owned banks. The author states that spreads are a function of six main factors: (i) the economic and financial conditions of the issuing bank; (ii) the time to maturity of the issue, as this affects its default risk premium (Merton, 1974); (iii) the issuance amount, as this in turn is believed to affect secondary market liquidity; (iv) any explicit or implicit government guarantees perceived by market investors; (v) the currency of denomination; and (vi) the time of issuance, as bond market conditions change over time. The risk sensitivity of subordinated debt spreads has been increasing over time, suggesting that implicit guarantees such as TBTF policies were present in the first half of the 1990s and were undermined during the second part of the decade.

Crespi et al. (2018) studied the pricing of Italian bonds using a sample of 1 798 bonds issued by 28 banks in the period between January 2013 and December 2016. Their sample mainly included senior bonds and they performed regressions based on bond characteristics (maturity, size, an indicator for listed bonds and an indicator for bond structure) and bank-level characteristics (rating, size, capital, liquidity, asset quality and profitability). They concluded that, after the introduction of the bail-in framework, issuing bonds became costlier for Italian banks. Consistently, banks characterised by better ratings, larger size and a lower level of NPLs were able to issue bonds at a lower spread. A higher Tier 1 ratio did not seem to be a selective factor for investors over the whole sample period.

Cutura (2018) and Lewrick et al. (2019) tackled the differences in spreads between bail-in and non-bail-in bonds. Cutura (2018) observed that investors perceived bail-in bonds to be riskier and demanded a bail-in premium of about 10–15 basis points in terms of the yield spread. Moreover, they found evidence that the bail-in premium was more pronounced for non-G-SII banks and banks domiciled in peripheral European countries, with weak capital levels as the main driver. Lewrick et al. (2019) analysed if investors monitored banks and price bail-in risk by comparing bail-in bonds with non-bail-in bonds issued by the same banking group. They gathered data on senior unsecured bonds for the period 2015–2018. First, in the case of those companies with structural subordination, they matched bonds issued by holding companies with bonds issued by a subsidiary. In other cases, they matched senior non-preferred bonds with senior preferred bonds. The currency had to be the same, and the maturities were not to differ by more than 6 months. Then they measured the price of bail-in as the difference between the option-adjusted spread in secondary markets on the bail-in bond and the option-adjusted spread on the corresponding non-bail in bond. They found a positive relationship between bank risk and bail-in bond premia, concluding that riskier banks face higher premia.

Taking a sample of 41 EU credit institutions, Pablos Nuevo (2019) studied the determinants of the spread between the yields on subordinated and senior unsecured bonds during the period 2014Q4–2018Q2. In this paper, the author obtained a positive coefficient of NPL ratio. Therefore, subordinated bondholders perceive impaired loans as resulting in higher credit risk exposure that could have effects on the future performance of the bank. The size variable is not statistically significant, maybe because the economies of scale in placing issuances affect both subordinated and senior bonds, and thus do not affecting the spreads between them.

As regards the policy issue of systemically important institutions and the TBTF funding subsidy, Babihuga et al. (2014) found evidence that larger, systemically important banks enjoyed a funding advantage and, contrary to expectations that the TBTF problem might be reduced by regulatory interventions, they showed that this advantage had increased since the onset of the GFC.

Balasubramnian and Cyree (2014) added to the existing literature on the risk sensitiveness of bank bond spreads a comparison between systemically important institutions' spreads before and after the entry into force of the Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010. In particular, they investigated if market discipline on banking firms changed after the Dodd–Frank Act (DFA) by interacting default risk variables with a Dodd–Frank Act indicator variable (the coefficients of the interaction variables should appear as significant). The authors concluded that the DFA had been effective in reducing, but not in eliminating, the size of and TBTF discounts on yield spreads. They found that there had been a TBTF discount of 187 basis points in the yield spreads during the pre-DFA period and that the TBTF discount had reduced by 176 basis points during the post-DFA period, a reduction of nearly 94% (i.e. the TBTF discount had reduced by 94% based on the coefficient of TBTF indicator * DFA, while the *SIZE* discount had reduced by 47% based on the coefficient of *SIZE* * DFA). Similarly to Balasubramnian and Cyree (2014), Crespi et al. (2018) observed that large banks paid a lower spread until 2015 but faced increased funding costs after 2015.

4. Methodology

4.1. Sample

Our empirical analysis relies on the construction of a dataset containing information on all the issuances of MREL-eligible debt performed by 63 European banking groups during the period 2009Q3–2019Q2 in 14 European countries. Specific data on the issuances (e.g. yield to maturity, bid–ask spread, time to maturity and ranking for the purposes of loss-absorbing capacity) come from Bloomberg. Bank-level information was collected from Orbis BankFocus (Bureau Van Dijk). All accounting and economic bank data were obtained on a consolidated basis for the banking groups.

As can be seen in Table 1a, Germany and France are the countries with the highest numbers of issuances in our sample period, with 99 and 82 issuances, respectively. Belgium, Ireland and Portugal are the countries with the lowest numbers of issuances. In terms of years, 2013 and 2014 constitute an inflection point, as from those years onwards the number of bank issuances showed a remarkable increase. This is consistent with the easing of monetary policy conditions, as evidenced by the fact that the main refinancing rate of the European Central Bank (ECB) was lowered below the hurdle of 1% during 2012Q3 and further lowered up to 50 basis points during 2013Q1.

In accordance with the new category of banks introduced by the BRRD II our sample is composed of 50 top-tier banks and 13 that are not considered top-tier banks, with most issuances performed by top-tier banks. The sample is varied also in terms of systemic importance, with 12 banks classified as G-SIIs, 41 classified as O-SIIs and 10 classified as non-systemic banks.

Table 1a: Total number of issuances by year and country

This table shows the numbers of issuances of all kinds of MREL-eligible debt by country and by year of issuance.

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
AT	–	1	–	1	2	–	–	2	1	1	–	8
BE	–	1	–	–	–	1	1	–	–	–	–	3
DE	2	6	1	3	3	11	20	9	16	7	21	99
DK	1	–	–	–	–	–	–	1	1	–	7	10
ES	–	–	1	1	5	3	7	9	9	4	2	41
FI	–	–	–	–	–	1	7	–	2	2	–	12
FR	1	6	–	1	6	11	5	11	4	3	34	82
GB	–	–	2	–	3	4	4	2	8	8	1	32
IE	–	–	–	–	1	1	–	–	2	–	–	4
IT	1	2	–	–	3	3	4	7	8	–	6	34
NL	–	–	1	1	4	1	4	5	5	4	3	28
NO	–	1	–	–	2	–	1	2	2	3	–	11
PT	–	–	–	–	–	–	–	–	1	2	–	3
SE	–	–	–	–	–	1	–	2	4	2	–	9
Total	**5**	**17**	**5**	**7**	**29**	**37**	**53**	**50**	**63**	**36**	**74**	**376**

Table 1b: Total Issuances in the sample by year and country (million EUR)

This table shows, in millions of euros, the issuances of all kinds of MREL-eligible debt by country and by year of issuance.

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
AT	–	500	–	2	503	–	–	550	400	500	–	2 455
BE	–	500	–	–	–	200	45	–	–	–	–	745
DE	1 100	730	1 391	550	1 950	6 070	4 515	9 903	4 596	620	5 757	37 182
DK	1 250	–	–	–	–	–	–	500	100	–	4 028	5 878
ES	–	–	385	1 500	4 970	4 000	5 474	2 976	4 781	2 660	2 000	28 745
FI	–	–	–	–	–	30	3 190	–	80	856	–	4 156
FR	1 250	7 250	–	1 031	4 080	10 095	4 603	12 662	4 000	1 006	20 632	66 609
GB	–	–	2 497	–	4 572	5 405	6 015	2 584	9 260	8 075	896	39 304
IE	–	–	–	–	750	1 002	–	–	756	–	–	2 508
IT	13	1 515	–	–	1 171	2 630	2 870	2 718	6 456	–	6 220	23 591
NL	–	–	1 288	1 016	5 315	1 500	4 013	4 238	4 743	4 978	2 760	29 849
NO	–	15	–	–	188	–	50	83	51	70	–	457
PT	–	–	–	–	–	–	–	–	50	800	–	850
SE	–	–	–	–	–	1 000	–	955	1 616	770	–	4 341
Total	**3 613**	**10 510**	**5 562**	**4 099**	**23 498**	**31 932**	**30 774**	**37 169**	**36 888**	**20 335**	**42 293**	**246 671**

4.2. Econometric model

In order to explain the determinants of the yield to maturity of MREL-eligible debt issued during 2009–2019 by European banks, we created a pooled regression model as follows:

$$YTM_{ijkt} = \beta_0 + \beta_1 * ISS_{ijkt} + \beta_2 * BKRISK_{jkt} + \beta_3 * CTRYCOND_{kt} + \beta_4 * MKTCOND_{kt} + \gamma_k + \mu_t + \varepsilon_{ijkt}$$

where *I*, *j*, *k* and *t* refer to the issuance, bank, country and time period, respectively. The dependent variable is the yield to maturity (*YTM*). *ISS* is a vector including the variables relating to issuance characteristics (e.g. maturity and bid–ask spread). *BKRISK* contains bank-specific variables related to profitability, asset quality, capital and business model. *CTRYCOND* refers to macroeconomic variables (e.g. real GDP growth) and variables related to financial system conditions in order to capture the influence of aggregate banking system conditions on bank-issued debt (e.g. market share of total assets in percentage points of the five largest banks, the NPL ratio for the system and return on assets (ROA) for the system). Finally, *MKTCOND* is a vector that contains indicators of the general conditions of the European equity markets (e.g. the EURO STOXX general index), bank-issued debt (e.g. the iTraxx subordinated financials index), market indicators of banking stability (e.g. swap spread) and the risk-free rate of the economy (e.g. sovereign 10-year yields). *γ_k* and *μ_t* are the country and year fixed effects. Finally, *ε_ijkt* is the error term.

Our empirical strategy is likely to be affected by potential endogeneity concerns. Bank-level determinants are likely to be endogenously determined and reverse causality is arguably possible. Although the abovementioned bank-level variables might logically be thought to influence the cost of funding, these costs could also be justifiably argued to have some impact on bank-level characteristics such as efficiency, profitability and capital ratio, or on the features of the business model. Therefore, in order to avoid this potential econometric issue, in all our estimates all bank-level control variables are lagged by 1 year to avoid simultaneity with the cost-of-funding variable.

4.3. Variables

4.3.1. Dependent variable

The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued by our sample of banks and obtained from Bloomberg (*YTM*). Summary statistics are presented in Table 2a. As can be observed, the *YTM* variable takes an on average value of 2.3. If we distinguish between G-SIIs and O-IIs, we can observe that the yield faced by G-SIIs is greater (2.7) than that faced by O-SIIs (2.1). This would be consistent with the fact that the amount issued by the former is greater than that issued by the latter. G-SIIs therefore issue at longer maturities, as can also be seen in Table 2a.

4.3.2. Issuance characteristics

In all the specifications of our empirical model, and in accordance with previous literature, we always consider a set of variables related to the characteristics of the issuance. These variables were collected from Bloomberg. Specifically, we introduce the time to maturity measured in years (*MATURITY*). According to Merton (1974), debt value is a decreasing function of the time to maturity. This is because time to maturity is positively correlated with debt yields and higher debt yields are associated with lower value of debt. In our sample of issuances and banks, we find that *MATURITY* takes an average value of 10.6 years. As mentioned above, G-SIIs issue at a longer maturity (11 years on average), whereas the mean value is 9.9 years for O-SIIs.

We also include a measure of issuance-specific liquidity through the bid–ask spread of bonds (*BIDASK*). This variable was also considered by Annaert et al. (2013) when searching for the determinants of banks' CDS quotes; they concluded that the bid-ask spread was determinant across the entire sample, and specifically during crisis

periods. From Table 2a, we can observe that issuances in our sample show an average bid–ask spread of 0.20. However, those offerings launched by O-SIIs present higher levels of liquidity, as shown by the tighter bid–ask spread for this set of entities (0.17).

Table 2a. Summary statistics on issuance characteristics

This table shows the main descriptive statistics of the characteristics of our sample of issuances. *AMOUNT* is the amount issued, measured in euro. *MATURITY* is the time to maturity of each issuance (in years). *YTM* is the yield to maturity of each of the MREL-eligible debt products issued. *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. All these variables have been collected from Bloomberg. SD, standard deviation.

Issuance characteristics	*AMOUNT* (EUR)	*MATURITY* (years)	*YTM* (pp)	*BIDASK* (pp)
Mean	704 993,152	10.6	2.3	0.20
G-SIIs	969 000 000	11.0	2.7	0.24
O-SIIs	551 000 000	9.9	2.1	0.17
Median	670 929 375	10.1	1.4	0.06
G-SIIs	1 020 000 000	10.1	2.9	0.06
O-SIIs	500 000 000	10.1	1.2	0.07
SD	583 036 000	5.2	2.2	1.35
G-SIIs	608 000 000	5.7	2.3	1.71
O-SIIs	493 000 000	4.6	2.2	1.07
Minimum	1 961 248	1.9	0	0
G-SIIs	1 961 248	1.9	0	0
O-SIIs	2 000 000	2.0	0	0
Maximum	3 000 000 000	30.4	10.6	22.20
G-SIIs	3 000 000 000	30.4	10.6	22.20
O-SIIs	2 370 000 000	27.9	10.5	17.19

4.3.3. Bank characteristics

Following previous literature (Crespi et al., 2018), we include several measures of the default risk of the issuing banks. In particular, we considered profitability, asset quality, capital, business model and size, as basic individual dimensions of risky behaviour on the part of banks. The main profitability indicator used in our model, not widely used in recent literature, is net interest margin (*NIM*). It captures the results of the recurrent activities of the bank as interest income and interest charges from bank-issued debt that undermine net interest margin. Therefore, it could be said that it is the component of the profit and loss account most affected by the entry into force of the BRRD in the EU banking sector. We also include the costs to income ratio (*COST*), in order to test the extent to which the yield to maturity of the issuance could be affected by the level of bank efficiency.

As the main indicator of asset quality, we use the NPL ratio (*NPLR*). We use the equity to assets ratio as the main indicator of bank capital (*EQUITY*). The customer deposits to total funding ratio is also included in order to capture the possible differences that could arise between business models (*DEPOSITS*). In this regard, we consider that a high ratio corresponds to banks with a retail business model, and the sign and significance of this parameter will lead us to conclude if retail banking activities entail higher costs of MREL-eligible debt. Finally, we use the natural logarithm of total assets to measure the influence of bank size on issuance costs (*SIZE*). This variable, combined with the model specifications explaining the yield to maturity in relation to systemic importance, could help in examining if the TBTF subsidy is still in present in the European banking sector after the setup of the resolution framework across the EU and the entry into force of BRRD II, which imposes more stringent subordination requirements for G-SIIs and top-tier banks.

In Table 2b, we present the mean values of all the bank-level variables used in the paper. We present this information for both top-tier banks (assets amounting to more than EUR 100 billion) and non-top-tier entities. In addition, we also show the main statistics for two reference periods (2009 and 2018) for the sample.

Table 2b. Summary statistics on bank-level characteristics

This table shows the mean values for the main variables that proxy for bank-level characteristics. We split our sample of banks into top-tier and non-top-tier banks, following the BRRD II criteria. Panel A presents the information using accounting and financial data as at the end of 2009. The data used in Panel B refer to the end of 2018. Weighted averages are calculated using total assets as the weighting factor. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity to total assets ratio and the customer deposits to total funding ratio, respectively. Finally, *SIZE* is measured as the natural logarithm of total assets (we present the averages of assets in millions of euro here). All bank-based indicators were obtained from Orbis BankFocus on a consolidated basis and from consolidated annual reports.

Panel A: end 2009 data

Bank type	*NIM*	*COST*	*NPLR*	*EQUITY*	*DEPOSITS*	*SIZE*
Non-top Tier	1.46	68.05	8.99	8.31	82.1	19 731
Top tier	2.95	63.61	4.12	4.48	49.65	825 936
Total	2.94	63.61	4.12	4.48	49.69	787 545

Panel B: end 2018 data

Bank type	*NIM*	*COST*	*NPLR*	*EQUITY*	*DEPOSITS*	*SIZE*
Non-top Tier	1.1	67.11	5.75	5.67	65.3	39 542
Top tier	0.9	71.93	3.6	5.18	52.24	771 454
Total	0.9	71.92	3.6	5.18	52.27	690 131

4.3.4. Country and market conditions

One of the contributions of our paper to the existing literature is the consideration of banking system-wide variables as important determinants of banks' debt yields. Macroeconomic conditions are captured through the quarterly real GDP growth rate (*GDP*), obtained from Eurostat. We have also introduced structural indicators relating to the banking system, such as the indicator of concentration in the banking system, measured through the share of total assets of the five largest banks (*MKTSHARE5*) obtained from the ECB Statistical Data Warehouse on an annual basis. We have also introduced indicators of the performance of the banking system in aggregate, such as the NPL ratio (i.e. to monitor asset quality in the banking system) and ROA (i.e. to monitor the profitability of the banking system), on an annual basis and obtained from the ECB Data Warehouse (*NPLsys* and *ROAsys*, respectively). Similarly to the bank-level variables, financial system indicators are lagged one period in order to control for potential endogeneity concerns.

Table 2c. Summary statistics on country and financial sector characteristics

This table shows the main descriptive statistics for the main variables that proxy for country- and banking sector-level characteristics, using end 2018 data. *GDP* is the quarterly growth rate of real GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country.

	GDP	*MKTSHARE5*	*NPLsys*	*ROAsys*
Mean	2	48	3	0.52
Standard deviation	1	24	2	0.36
Minimum	–1.1	29	1.1	0.19
Maximum	3	85	9	2

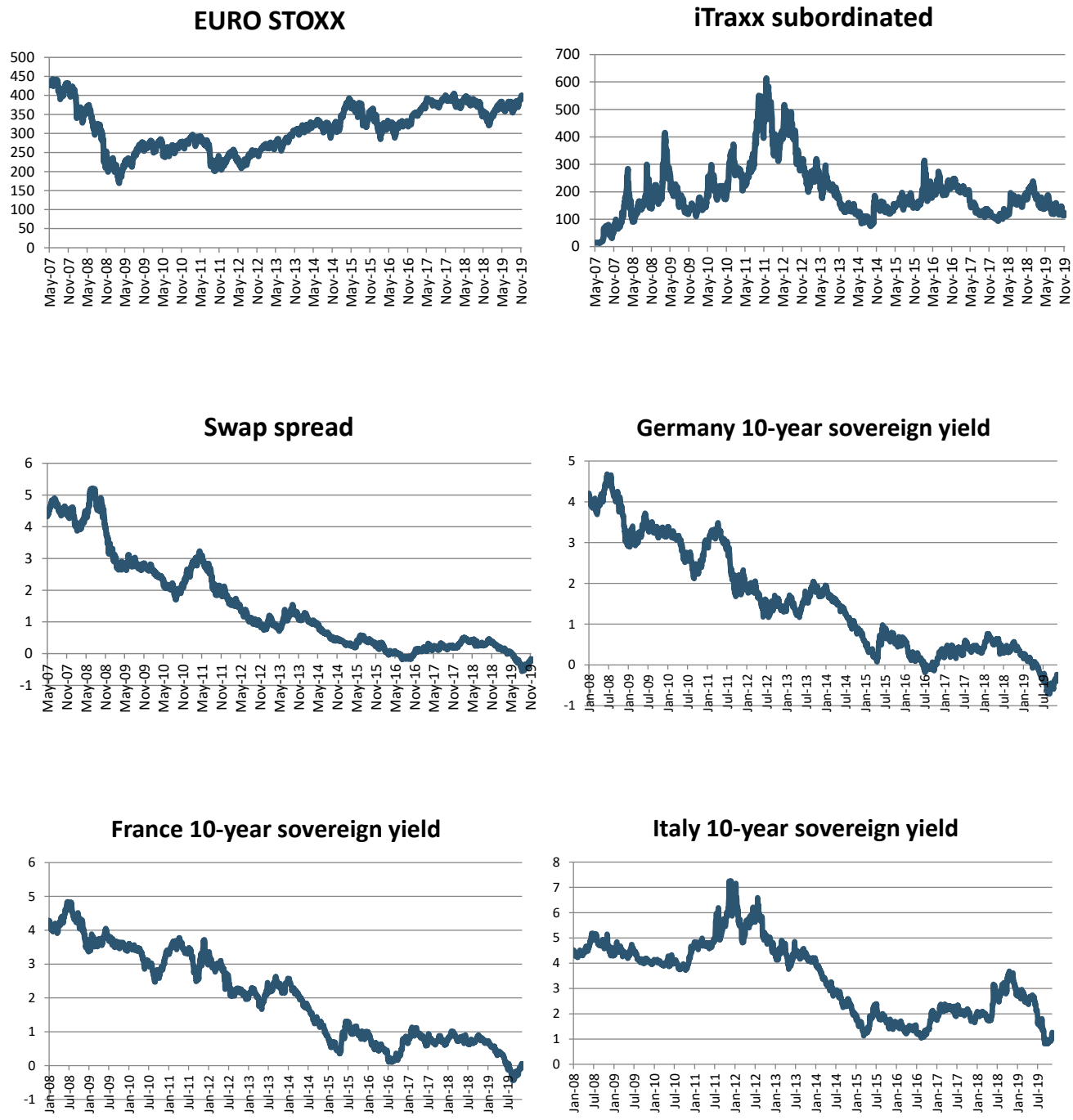
In terms of market variables, the vector *MKTCOND* aims to capture how market conditions change over time and potentially have an effect on the yield to maturity of banks' MREL-eligible debt products. Similarly to Annaert et al. (2013), Boss and Scheicher (2002), Cremers et al. (2008) and Pablos Nuevo (2019), among others, we incorporate market-wide and corporate bond indicators into our regression models. Therefore, we use the EURO STOXX general index (*EUROSTOXX*) as an indicator of the state of general equity markets, obtained from

Bloomberg. We also include the iTraxx subordinated financials index as the indicator for banks' bonds (*ITRAXX*), an independent variable not widely used in the literature. The relationship of the EURO STOXX index with our dependent variable is expected to be negative, while the relationship between iTraxx subordinated and the dependent variable is expected to be positive, as iTraxx subordinated captures the subordinated debt yields of 30 financial entities from the Markit iTraxx Europe index. The different behaviours of the two indicators with the dependent variable derive from the fact that the EURO STOXX general index is an equity index while iTraxx subordinated is a corporate bond index.

According to Merton (1974), the value of a particular issue of corporate debt depends, among other things, on the rate of return of the riskless debt of the economy. Therefore, we incorporate into our model the applicable risk-free rate for each country (*SOVEREIGN*), in order to test the bank–sovereign nexus in the European banking sector. Other recent studies have used other proxies to account for the risk-free rate. Pablos Nuevo (2019), for instance, incorporates overnight interest rates for the different areas included. However, we wanted to include the variable that is most commonly used to calculate banks' bond spreads (i.e. government bonds). There is scant literature on the determinants of bank bond yields; however, Boss and Scheicher (2002) state that the differences between banks' bond yields and government bond yields may reflect the market assessment of default risk. Therefore, sovereign yields are expected to be one of the key determinants of banks' bond yields. To increase the robustness of our results, we have applied the corresponding government yield to each country of issuance. This represents a contribution to the existing literature, as the model of Boss and Scheicher (2002) refers to German 10-year bonds. The relationship between banks' bond yields and sovereign bond yields is expected to be positive.

Finally, we include swap spread (*SWAPSP*), widely considered an indicator of banking stability (see, for example, Boss and Scheicher, 2002; Annaert et al., 2013). The swap spread is calculated as the difference between the mid-5-year interest rate swap (IRS) and the reference for a euro 5-year sovereign bond, taken from Bloomberg. In Figure 1, we can observe notable increases in the swap spread during the 2008 and 2011 crises. The expected relationship with banks' bond yields is positive.

Figure 1. Evolution of market indicators, 2007/2008–2019



Source: Bloomberg. EURO STOXX Index represents the capitalisation of large, mid and small companies across Europe (quoted prices). 'iTraxx subordinated' denotes the index for subordinated debt of the European market provided by Markit (price quoted in basis points). Swap spread is the difference between the mid-5-year interest rate swap (IRS) and the reference for a euro 5-year sovereign bond. Risk free rates are the 10-year government bond yields (measured in percentage points).

5. Empirical results

5.1. Determinants of MREL-eligible debt yields: basic model

In this section, we present the results of the basic model examining the determinants of yield to maturity of MREL-eligible debt products in our sample of issues and banks across Europe. Our basic set of results are presented in Table 3. In column (1), we first present the basic model specification for the entire sample of issues and banks and including the variables that measure issue- and bank-level characteristics. In column (2), we introduce the set of macroeconomic and banking system variables. Finally, in column (3), we report the complete specification of the basic model including also market risk variables.

As regards the issue-level characteristics, in all the three estimates *MATURITY* presents a positive and statistically significant coefficient, as expected. In line with the Merton model (1974), a longer period to maturity of MREL-eligible products entails higher yield. Although negative, the coefficient for the *BIDASK* variable is not significant at conventional levels.

Regarding the bank-level characteristics, in all the estimates shown in Table 3, all the variables show the expected signs. Both *COST* and *DEPOSITS* appear with statistically significant coefficients in all the estimates. These results suggest that banks with higher inefficiency levels and with high reliability on customer deposits as a source of funding – mainly retail banks – suffer a higher cost of MREL-eligible debt. The more retail-oriented business of banks with higher values for the customer deposits to total funding ratio would be consistent with the lack of experience in issuing debt traditionally shown by these kinds of banking entities.

As regards *NIM*, it shows a negative sign for its coefficient in column (1), suggesting that higher profitability entails lower yield to maturity. Although negative, the coefficient is not statistically significant in columns (2) and (3). As expected, the NPL ratio positively influences MREL-eligible debt yields, although it is statistically significant only in column (2) of Table 3. This result may suggest that a lower level of asset quality, proxied by a high NPL ratio, is associated with higher cost of MREL-eligible debt. The size variable (*SIZE*) presents a positive coefficient, indicating that large banks experience higher funding costs, which could be a result of the end of TBTF subsidies. However, this coefficient is significant only in column (3), when the complete set of explanatory variables is considered. The equity to assets ratio always has a non-significant coefficient.

As regards the market risk variables, the four variables emerge as significant determinants of MREL-eligible debt yields. In particular, *ITRAXX* and *SOVEREIGN* are significant at 1% with the expected positive sign. The fact that higher sovereign yields entail higher MREL-eligible debt costs could be seen as more evidence that the bank–sovereign nexus is still very strong in the European banking sector, although the project of the Banking Union is at a very advanced stage. In relation to iTraxx, although the index is composed of subordinated debt, the higher significance and the correct sign lead us conclude that it represents the key reference for investors to monitor the situation on the market for bank-issued debt. Finally, although swap spread appears significant, the negative sign could have been driven by a misalignment between yield to maturity and swap spread during recent years. The declining trend in swap spread during recent years has mainly been caused by increased banking stability after the 2011–2012 crisis, but MREL-eligible debt yields have been increasing as a result of lower expectations of bail-out among investors.

Finally, the complete basic model presented in column (3) contains the macroeconomic and banking system variables. Although all of them show the expected sign, only ROAsys presents a statistically significant coefficient at a 5% level. The fact that ROA is significant and has the expected sign could suggest that investors monitor profitability both at bank level and at a system-wide level. Moreover, this could be a sign that the profitability of the host banking system influences banks' consolidated profitability through the influence on MREL issuance costs, although systemic institutions use diversified business models to obtain additional sources of profitability and mitigate the nexus with the domestic banking system. Therefore, banks should closely monitor the

profitability of the banking system in which they are established. Moreover, this result could also be evidence of the strength of the bank–sovereign nexus in the European banking sector. Banks' costs in relation to MREL-eligible debt yields are correlated to the performance of the national banking sector. This may lead us to conclude that further efforts to finish the project of the Banking Union are necessary to reduce the correlation between banks' performance and national banking systems' performance.

Table 3: Determinants of MREL-eligible debt yields – basic model

This table shows the results of the basic model on the determinants of MREL-eligible debt yields in the entire sample of banks and issues. The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued (*YTM*). *MATURITY* is the time to maturity of each issuance (in years). *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity to total assets ratio and the customer deposits to total funding ratio, respectively. *SIZE* is measured as the natural logarithm of total assets. *EUROSTOXX* is as an indicator of the state of general equity markets. *ITRAXX* is included as the indicator for banks' bonds. *SOVEREIGN* is the risk-free rate in each country. *SWAPSP* is the difference between the mid-5-year IRS and the reference for a euro 5-year sovereign bond. *GDP* is the quarterly growth rate of GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country. Country and time fixed effects are included, although their coefficients are not reported. Standard errors appear in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

	(1)	(2)	(3)
MATURITY	0.551***	0.641***	0.649***
	(0.078)	(0.078)	(0.079)
BIDASK	–1.066	–0.335	–0.412
	(0.882)	(0.856)	(0.874)
NIM	–0.161*	–0.063	–0.065
	(0.083)	(0.083)	(0.083)
COST	0.150*	0.156*	0.140*
	(0.084)	(0.080)	(0.081)
NPLR	0.133	0.152*	0.130
	(0.084)	(0.080)	(0.086)
EQUITY	0.008	–0.055	–0.032
	(0.090)	(0.086)	(0.087)
DEPOSITS	0.473***	0.479***	0.502***
	(0.085)	(0.083)	(0.086)
SIZE	0.087	0.099	0.110*
	(0.067)	(0.064)	(0.064)
EUROSTOXX	–	0.190	0.234*
	–	(0.122)	(0.123)
ITRAXX	–	0.304***	0.308***
	–	(0.087)	(0.087)
SWAPSP	–	–0.222**	–0.235**
	–	(0.107)	(0.106)
SOVEREIGN	–	0.245***	0.234***
	–	(0.071)	(0.072)
GDP	–	–	–0.100
	–	–	(0.074)
MKTSHARE5	–	–	–0.098
	–	–	(0.080)
NPLsys	–	–	0.021
	–	–	(0.085)
ROAsys	–	–	–0.185**
	–	–	(0.077)
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Observations	380	380	380
R-squared	0.239	0.320	0.338

5.2. Determinants of MREL-eligible debt yields: the impact of systemic importance

Having examined the impact of the various issuance-, bank-, country- and market-level determinants of MREL-eligible debt yields over the entire subsample of banks and issues, in this section we analyse in greater depth the details of the relationships examined above. Specifically, we now test if the results previously shown are homogeneous across banking institutions with different levels of systemic importance. To do that, in Table 4 we split our sample into three subsamples of banks classified by their systemic importance. In particular, in column (1) we present the results obtained for the subsample of banks classified as G-SIIs. In column (2), the results for the subsample of O-SIIs are reported. Finally, column (3) shows the results of the model run on the sample of other banks (i.e. those that do not fulfil the criteria to be considered either a G-SII or an O-SII).

As can be seen, in both column (1) and column (2) the *MATURITY* variable appears with the expected positive and statistically significant coefficient. Consistently with the results shown in Table 3, regardless of the level of systemic importance of banks, we find no evidence on the effect of *BIDASK* on the yield to maturity of issues of MREL-eligible debt products.

In terms of the bank-level variables, it could be stated that to some extent there is a higher risk perception for O-SIIs than for G-SIIs. Regarding G-SIIs, only the size indicator is significant and with a negative sign, indicating that the larger the size, the lower the cost. Therefore, we observe the existence of TBTF subsidies for these types of entities. Consistently, the market still perceives a low probability of default for them. In the case of the O-SIIs subsample, *NPLR* has a positive and highly significant coefficient, suggesting that investors perceive asset quality of this set of banks when pricing their financial products (i.e. a deterioration in asset quality indicators entail higher funding costs). For this group, the proportion of customer deposits in banks' balance sheets (*DEPOSITS*) is highly significant and has a positive sign, indicating a greater cost of funding for retail banks. Traditionally, retail banks rely on deposits as their main funding source and their access to wholesale markets has been more limited, particularly in Europe.

In a similar vein, market risk variables appear to be more significant for O-SIIs than for G-SIIs. *EUROSTOXX* appears as a significant determinant of the yield to maturity of MREL-eligible debt products in the subsample of O-SIIs. In both subsamples of banks, however, the iTraxx subordinated financials index presents a positive and statistically significant coefficient. A similar pattern can be observed in the case of the 10-year domestic sovereign debt indicator (*SOVEREIGN*). Therefore, these results show that the bank–sovereign nexus problem is a stronger feature of O-SIIs than of G-SIIs.

Finally, as regards the macroeconomic and banking system indicators, we observe that the concentration ratio and the *ROAsys* variable appear as significant determinants only for the subsample of G-SIIs. The negative coefficient of the concentration ratio indicates that higher levels of concentration in the banking market are perceived positively by the market, entailing a lower level of bank debt yield. Similarly, the indicator of profitability (ROA) is highly significant for G-SIIs, with its coefficient having a negative sign (i.e. higher profitability of the system is perceived positively by investors in debt issued by the biggest banks). The largest banks usually have more diversified business models, and their profitability carries significant weight with regard to whole-system profitability (*ROAsys*). Finally, the GDP indicator shows a negative coefficient in columns (1) and (2), although it is statistically significant only for the subsample of O-SIIs. This suggests that the effect of the business cycle is more relevant for O-SIIs.

From this analysis, we can conclude that G-SIIs are perceived as less risky by investors in terms of the main dimensions analysed in this paper. In particular, bank- and market-level variables emerge as having a potential differential impact on the yield to maturity of the MREL-eligible debt issued by different types of banks.

Table 4: Determinants of MREL-eligible debt yields – the impact of systemic importance

This table shows the results of the basic model on the determinants of MREL-eligible debt yields by subsamples of banks according to their systemic importance. The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued (*YTM*). *MATURITY* is the time to maturity of each issuance (in years). *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity over total assets ratio and the customer deposits to total funding ratio. *SIZE* is measured as the natural logarithm of total assets. *EUROSTOXX* is as an indicator of the state of general equity markets. *ITRAXX* is included as the indicator for banks' bonds. *SOVEREIGN* is the risk-free rate in each country. *SWAPSP* is the difference between the mid-5-year IRS and the reference for a euro 5-year sovereign bond. *GDP* is the quarterly growth rate of GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country. Country and time fixed effects are included, although their coefficients are not reported. Standard errors appear in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

	(1) G-SIIs	(2) O-SIIs	(3) Other
MATURITY	0.765***	0.506***	0.272
	(0.119)	(0.120)	(0.587)
BIDASK	–3.205	–0.279	0.484
	(2.798)	(0.696)	(9.697)
NIM	–0.074	0.035	–0.280
	(0.126)	(0.110)	(2.148)
COST	0.048	0.193	–0.324
	(0.122)	(0.128)	(1.017)
NPLR	0.073	0.420***	–0.014
	(0.169)	(0.150)	(0.571)
EQUITY	0.306	–0.123	–0.751
	(0.270)	(0.133)	(1.476)
DEPOSITS	0.038	0.402***	0.607
	(0.267)	(0.107)	(1.075)
SIZE	–0.783**	0.032	–0.338
	(0.384)	(0.099)	(1.262)
EUROSTOXX	0.091	0.349**	–0.515
	(0.218)	(0.162)	(0.714)
ITRAXX	0.438***	0.317***	–0.245
	(0.149)	(0.119)	(0.367)
SWAPSP	–0.317**	–0.129	–0.227
	(0.153)	(0.152)	(0.915)
SOVEREIGN	0.247*	0.206**	–0.663
	(0.126)	(0.088)	(0.793)
GDP	–0.036	–0.214**	0.026
	(0.108)	(0.100)	(1.359)
MKTSHARE5	–0.413**	0.114	0.134
	(0.164)	(0.103)	(1.088)
NPLsys	–1.581	–0.082	2.428
	(1.167)	(0.087)	(2.341)
ROAsys	–0.404***	0.102	0.945
	(0.122)	(0.102)	(1.385)
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Observations	154	202	24
R-squared	0.467	0.371	0.659

5.3. Determinants of MREL-eligible debt yields: the impact of the post-BRRD I environment

In this section, we examine the different levels of risk perception that, across different issuance-, bank-, country- and market-level dimensions, investors in MREL-eligible debt had before and after the entry into force of BRRD I. Moreover, we also aim to assess the impact of unconventional monetary policies on investors' risk sensitiveness. BRRD I entered into force on January 2015 and the Level 1 legislation aimed at avoiding public bail-outs became applicable across the EU. Therefore, the expectation that state aid would be provided using public funds was lower than in the past. In addition, after the GFC, a set of unconventional monetary policies were in place. TLTROs were launched to underpin credit to non-financial corporations and households in the euro area. Participating banks could borrow from the ECB up to a certain percentage of their outstanding loans to business and consumers (i.e. 30% under TLTRO II) at a cost equal to the main ECB interest rate. These favourable funding conditions were put in place to underpin credit growth and the real economy, ensuring the transmission of monetary policy. The improvement of macroeconomic indicators in the euro area during the implementation of unconventional monetary policies combined with the lower responsiveness of sovereign yield spreads to their determinants (Afonso and Kazemi, 2018) led us to examine whether or not banks' debt yields became less responsive to their determinants as well. In this regard, if risk sensitiveness were undermined during TLTRO periods, that could be another negative effect of expansionary monetary policy.

In Table 5, we show the results obtained. Columns (1) and (2) show the results obtained for the pre- and post-BRRD I implementation periods, respectively. In columns (3) to (5), we present the empirical findings on the impact of the different determinants of yield to maturity for periods defined with regard to the various unconventional monetary policy tools applied.

We observe that, in general terms, there was increased risk sensitiveness on the part of investors after the entry into force of BRRD I, as expected. In particular, the NPL ratio of individual banks presents a non-significant coefficient in column (1), whereas it is positive and statistically significant in column (2), where the period after the entry into force of BRRD I is examined. Regarding the signs of the coefficients of the rest of the variables, during the pre-BRRD I period, all of them show the expected sign, except *NPLR*. During the post-BRRD I period, the exception is *NIM*, as it presents a positive sign.

In relation to market risk variables, iTraxx for subordinated debt retains the same sign and level of significance during the period after the entry into force of BRRD I. The indicator of the general state of the market (*EUROSTOXX*) loses significance during the post-BRRD I period, which could be related to the fact that investors become more focused on changes in equity markets during crisis periods, but their attention is lower during expansionary periods. *SOVEREIGN* becomes positive and significant during the post-BRRD I period, which could be evidence of two issues: (i) the strong bank–sovereign nexus, still present despite all the post-crisis regulatory reforms and the commitment of European authorities to completing the project of the Banking Union, and (ii) the importance of sovereign yields as the risk-free rate for banks' financing. The importance of *SOVEREIGN* as a determinant of bank debt yield was not undermined by the asset purchases programmes undertaken by the ECB during this period.

Regarding the banking system-wide indicators, we do not observe important differences across the subsamples. Instead, we observe that during the post-BRRD I period *MKTSHARE5*, *NPLsys* and *ROAsys* all present the expected sign. Regarding the system-wide NPL ratio, during the pre-BRRD I period we observe a negative sign, thus confirming the abovementioned explanation related to the fact that investors were not risk-sensitive during this period, either on an individual bank basis or on a system-wide basis. Instead, the entry into force of BRRD I increased risk sensitiveness from both perspectives (bank and financial system), and the NPL ratio for the system shows a positive sign (i.e. the larger the ratio for the banking system, the larger the yield that banks have to pay for their issued debt). Therefore, this leads us to conclude that, although banks may present diversified business models, they are highly influenced by system-wide variables, which is reflected in the costs they pay for their debt.

Finally, macroeconomic sensitiveness, measured through the growth rate of real GDP, becomes significant during the post-BRRD I period, suggesting that banks' performance is strongly correlated with macroeconomic conditions.

As regards the effect of the implementation of the unconventional monetary policy measures, we observe that during TLTRO periods there seems to be a lower level of risk sensitiveness. This is particularly true in the case of bank- and market-level variables, as some key variables that appear significant in the basic model lose their significance during TLTRO periods. This could be an indicator of investors monitoring banks in a less accurate way when unconventional monetary policies are in place.

In columns (4) and (5), we examine the risk sensitiveness of banks' bond yields during the first two TLTRO series separately. The first TLTRO programme was implemented in the period September 2014 to June 2016, whereas the second ran from June 2016 to March 2017. In the case of the subsample of issuances launched during TLTRO I, we observe differences in both the signs and significance of the coefficients of the main variables of interest compared with the basic model. Regarding bank-level variables, the NPL ratio presents a negative coefficient, whereas the costs to income ratio has lost its statistical significance. The ratio of customer deposits to total funding loses significance, as does the bank size indicator. Therefore, during this first TLTRO, banks' yields were less sensitive to bank-level risk variables. In relation to the market risk variables, iTraxx subordinated shows a lower level of significance, while swap spread and sovereign yields completely lose significance. Regarding banking system-wide variables, the NPL ratio at banking sector level appears with a negative sign, behaving exactly as the bank-level NPL ratio. The level of profitability in the banking system (*ROAsys*) loses significance.

The same conclusion in terms of undermined risk sensitiveness applies to TLTRO II. However, in relation to bank-level variables and banking system-wide variables, we perceive more risk sensitiveness than during the TLTRO I period. Regarding bank risk variables, the costs to income ratio and the size indicator lost significance. *EQUITY*, however, emerges as a significant determinant of debt yields, with the expected negative sign. *DEPOSITS* shows a positive and statistically significant coefficient in all the estimates.

Regarding market risk variables, all of them lose significance in columns (4) and (5). Finally, in this period the NPL ratio of the banking system presents a positive and significant coefficient in column (4).

Table 5: Determinants of MREL-eligible debt yields across time – the impact of the post-BRRD I and TLTRO environments

This table shows the results of the basic model on the determinants of MREL-eligible debt yields by subsamples of issues across different subperiods defined by the implementation of the BRRD I and the various TLTRO programmes. The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued (*YTM*). *MATURITY* is the time to maturity of each issuance (in years). *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity to total assets ratio and the customer deposits to total funding ratio, respectively. *SIZE* is measured as the natural logarithm of total assets. *EUROSTOXX* is as an indicator of the state of general equity markets. *ITRAXX* is included as the indicator for banks' bonds. *SOVEREIGN* is the risk-free rate in each country. *SWAPSP* is the difference between the mid-5-year IRS and the reference for a euro 5-year sovereign bond. *GDP* is the quarterly growth rate of GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country. Country and time fixed effects are included, although their coefficients are not reported. Standard errors appear in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

	(1) Pre-BRRD (until December 2014)	**(2) Post-BRRD (from December 2014)**	**(3) TLTRO I**	**(4) TLTRO II**	**(5) Post-TLTRO**
MATURITY	0.990***	0.610***	1.007***	0.606**	0.597***
	(0.228)	(0.084)	(0.242)	(0.230)	(0.093)
BIDASK	0.926	–1.729	1.010	0.079	–2.583
	(0.956)	(1.474)	(1.001)	(2.746)	(1.842)
NIM	–0.073	0.083	–0.057	0.134	0.015
	(0.121)	(0.147)	(0.127)	(0.284)	(0.178)
COST	0.145	0.147	0.058	0.040	0.257**
	(0.211)	(0.092)	(0.256)	(0.167)	(0.116)
NPLR	–0.041	0.238**	–0.002	–0.127	0.179
	(0.195)	(0.098)	(0.258)	(0.185)	(0.123)
EQUITY	–0.078	–0.103	–0.120	–0.789***	0.051
	(0.207)	(0.100)	(0.255)	(0.238)	(0.129)
DEPOSITS	0.509***	0.418***	0.528**	0.641***	0.340***
	(0.187)	(0.109)	(0.203)	(0.224)	(0.125)
SIZE	0.073	0.091	0.049	–0.112	0.101
	(0.164)	(0.071)	(0.174)	(0.149)	(0.086)
EUROSTOXX	1.019**	0.171	1.163**	0.057	0.104
	(0.472)	(0.190)	(0.512)	(0.249)	(0.316)
ITRAXX	0.414**	0.362**	0.464**	0.328	0.219
	(0.183)	(0.170)	(0.203)	(0.222)	(0.228)
SWAPSP	0.005	–0.382	0.065	–0.138	–0.555
	(0.184)	(0.404)	(0.205)	(0.697)	(0.595)
SOVEREIGN	–0.001	0.288***	–0.059	0.190	0.375***
	(0.157)	(0.081)	(0.168)	(0.143)	(0.102)
GDP	–0.053	–0.149*	–0.082	–0.096	–0.142
	(0.156)	(0.088)	(0.165)	(0.266)	(0.096)
MKTSHARE5	–0.203	–0.093	–0.232	–0.199	–0.053
	(0.254)	(0.091)	(0.265)	(0.197)	(0.115)
NPLsys	–0.052	0.220	–0.072	2.312***	0.211
	(0.131)	(0.139)	(0.147)	(0.771)	(0.147)
ROAsys	–0.136	–0.153	–0.136	0.422	–0.237**
	(0.127)	(0.104)	(0.133)	(0.298)	(0.114)
Country dummies	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
Observations	103	277	95	86	199
R-squared	0.318	0.393	0.326	0.426	0.430

5.4. Determinants of MREL-eligible debt yields: the impact of the type of debt

In this section, we consider that the particular type of debt issued by the bank may also have an influence on the final impact of the various bank-, issue-, country- and market-level determinants of yield to maturity. For this analysis, we ran our basic model over different subsamples of issues defined by debt type. The results obtained are shown in Table 6. In column (1), we present the results for the subsample of subordinated debt products. Columns (2) and (3) report the empirical findings obtained for the subsamples of senior non-preferred and senior unsecured debt products, respectively.

In all the estimates, the positive impact of maturity on the *YTM* dependent variable remains. The coefficient of the *BIDASK* variable, although negative, is statistically significant only for the subsample of senior unsecured debt. As can be seen in column (2), the model for senior non-preferred debt presents the highest number of significant coefficients for the yield to maturity determinants. The category of senior non-preferred debt was created in Directive (EU) 2017/2399, which amended Directive 2014/59/EU as regards the ranking of unsecured debt instruments in the insolvency hierarchy. In recent years, senior non-preferred debt, which is eligible for covering the subordinated requirement within the overall MREL requirement, has been the most common type of issuance used to fulfil MREL subordinated requirements because it is the kind of subordinated issuance with the lowest associated yield to maturity. According to our results, therefore, it seems that investors are closely monitoring bank risk characteristics, market risk characteristics, and macroeconomic and banking sector variables for this type of debt. This means that, to some extent, the market discipline that has been traditionally exercised through subordinated debt is currently being exercised through senior non-preferred debt, particularly since the introduction of this kind of debt for bail-in purposes by Directive (EU) 2017/2399.

Regarding bank-level variables, *COST*, *NPLR* and *SIZE*, show a positive coefficient, whereas *EQUITY* presents the opposite sign. In terms of market variables, *SOVEREIGN* has the expected positive sign and it is significant at a 1% level, confirming the existence of the bank–sovereign nexus and the reliability of sovereign yields as the risk-free rate for banks' bonds. Consistently with previous results, the *ITRAXX* variable remains positive.

As regards the impact of real GDP growth, the negative and statistically significant coefficient obtained suggests that GDP growth is associated with lower yield, which confirms the strength of the bank–sovereign nexus and the importance of macroeconomic indicators for banks' performance. Bank concentration ratio (*MKTSHARE5*) shows a negative and significant coefficient, consistently with the fact that a more concentrated banking sector is beneficial in terms of lower funding costs for MREL-eligible debt. The negative coefficient obtained for the *NPLsys* variable suggests an opposite association between the soundness of the banking sector of each country and the cost of senior non-preferred debt products. This result may indicate that in times of certain levels of financial instability, senior non-preferred debt can impose on banks a less stringent commitment to its creditors that may be useful in gaining financial resources during a period when traditional financing may be constrained.

The results obtained for senior unsecured bonds are presented in column (3). In accordance with expectations, we find a negative coefficient for the *BIDASK* variable. We also find negative coefficients for *NIM* and *EQUITY*, as expected. The effect of *DEPOSITS* on the yield to maturity of this type of debt is positive and statistically significant at conventional levels. However, neither the market- nor the macroeconomic-level variables show significant coefficients. Regarding banking system characteristics, the concentration ratio (*MKTSHARE5*) and the NPL ratio for the banking system are significant at a 5% level and with the expected positive sign.

Finally, for subordinated debt issuances (column (1)), only the coefficients relating to capital (equity to assets ratio), customer deposits over total funding and iTraxx subordinated are significant, with only the last two having the expected sign.

Table 6: Determinants of MREL-eligible debt yields – the impact of the type of debt

This table shows the results of the basic model on the determinants of MREL-eligible debt yields by subsamples of different types of debt. The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued (*YTM*). *MATURITY* is the time to maturity of each issuance (in years). *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity to total assets ratio and the customer deposits to total funding ratio, respectively. *SIZE* is measured as the natural logarithm of total assets. *EUROSTOXX* is as an indicator of the state of general equity markets. *ITRAXX* is included as the indicator for banks' bonds. *SOVEREIGN* is the risk-free rate in each country. *SWAPSP* is the difference between the mid-5-year IRS and the reference for a euro 5-year sovereign bond. *GDP* is the quarterly growth rate of GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country. Country and time fixed effects are included, although their coefficients are not reported. Standard errors appear in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

	(1) Subordinated	(2) Senior non-preferred	(3) Senior unsecured
MATURITY	0.727***	0.543***	1.240***
	(0.151)	(0.076)	(0.234)
BIDASK	–0.887	–2.111	–10.879*
	(1.055)	(1.375)	(5.961)
NIM	–0.039	0.013	–1.130***
	(0.172)	(0.067)	(0.375)
COST	0.210	0.185**	–0.178
	(0.134)	(0.093)	(0.157)
NPLR	0.081	0.378***	–0.188
	(0.157)	(0.124)	(0.123)
EQUITY	0.263*	0.303*	–0.549**
	(0.156)	(0.162)	(0.241)
DEPOSITS	0.379***	–0.032	1.049***
	(0.139)	(0.090)	(0.341)
SIZE	–0.147	0.342***	0.089
	(0.098)	(0.088)	(0.185)
EUROSTOXX	0.206	0.232	0.171
	(0.167)	(0.167)	(0.274)
ITRAXX	0.443***	0.304**	0.008
	(0.122)	(0.137)	(0.162)
SWAPSP	–0.144	–0.129	0.231
	(0.142)	(0.138)	(0.347)
SOVEREIGN	0.110	0.228***	0.097
	(0.121)	(0.083)	(0.146)
GDP	–0.028	–0.176***	0.016
	(0.137)	(0.061)	(0.224)
MKTSHARE5	–0.156	–0.454***	–0.451**
	(0.149)	(0.124)	(0.185)
NPLsys	–0.075	–1.466*	2.029**
	(0.096)	(0.847)	(0.966)
ROAsys	0.161	–0.145	–0.268*
	(0.133)	(0.128)	(0.133)
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Observations	170	152	56
R-squared	0.354	0.680	0.664

5.5. Determinants of MREL-eligible debt yields: the impact of credit rating

Bank rating is one particular characteristic that it is not among the bank-specific variables already introduced through our specifications. In this section, we aim to examine in detail if investors exercise market discipline through monitoring bank ratings. For this analysis, we split our sample of banks according to their rating results (i.e. rating at issuance). According to Moody's rating scale, A1 and A2 obligations entail low credit risk, a Baa rating implies moderate credit risk and Ba1 obligations have speculative elements and are subject to significant credit risk. The empirical findings are presented in Table 7.

In all the estimates shown in Table 7, both *MATURITY* and *BIDASK* present the expected coefficients. *MATURITY* is statistically significant for all the subsamples of banks, indicating no differences in terms of its effects on *YTM* across different rating levels. *BIDASK* shows a statistically significant result only in column (6), indicating that its negative effect on yield to maturity is particularly relevant in the case of banks with the lowest ratings.

In terms of bank-level characteristics, we observe variations in the sign and significance of some coefficients across the different subsamples. This indicates potential interaction between these bank-level features and the rating grades of the entities. As in previous tables of results, *NIM* shows a negative coefficient in column (3), whereas it turns positive in column (4) for the subsample of banks with a Baa2 grade. As regards the NPL ratio at bank level, the reported results show a negative and significant coefficient for the subsample of banks with a Baa2 grade, indicating that these banks may benefit from a substitute effect between their rating grade and the quality of their assets. This result is very similar to that suggested by the positive coefficient of the *EQUITY* variable for this subsample of banks. In terms of *SIZE*, the significant result in column (2) suggests that the largest banks with higher rating grades experience a lower cost of MREL-eligible debt. The positive coefficient of *SIZE* in column (5) suggests completely the opposite. In fact, the largest banks are penalised the most, in terms of higher yield to maturity of their debt products, when they receive a Baa3 grade.

As regards the market variables, no important effects emerge from the analysis of subsamples of banks with different rating grades. Finally, in terms of macroeconomic and banking sector variables, our results confirm the importance of the business cycle to promoting lower funding costs for those entities with better rating grades. An interesting result emerges when we focus on the impact of banking market concentration. We obtain a positive coefficient for *MKTSHARE5* in column (2), whereas this coefficient becomes negative and statistically significant in column (6). The existence of a more concentrated banking market is more beneficial for those banks with lower rating grades than for those that are better positioned in terms of credit risk. In other words, the lowest funding costs for MREL-eligible debt are for banks with higher ratings in countries with more polarised banking markets. Finally, *NPLsys* presents a negative coefficient in column (4), suggesting that lower levels of financial stability in the banking sector help to reduce the funding costs for those banks classified as subject to moderate credit risk (Baa2).

Overall, it emerges that investors monitor those bank debt issuances that present moderate to high levels of credit risk more than those debt products issued by banks with better rating grades. This means that credit ratings are seen as a high-credibility tool, helping investors in the market to better exercise market discipline. Indeed, credit ratings seem to act as complementary mechanisms to the features that, from bank-, issuance-, market- and country-level perspectives, help in assessing the risk sensitiveness of MREL-eligible debt products.

Table 7: Determinants of MREL-eligible debt yields – the impact of credit ratings.

This table shows the results of the basic model on the determinants of MREL-eligible debt yields by subsamples of different rating grades defined by Moody's. The dependent variable is the yield to maturity of each of the MREL-eligible debt products issued (*YTM*). *MATURITY* is the time to maturity of each issuance (in years). *BIDASK* is the bid–ask spread, which approximates the level of liquidity of the specific issuance. *NIM* is the net interest income. *COST* refers to the costs to income ratio. *EQUITY* and *DEPOSITS* denote the equity to total assets ratio and the customer deposits to total funding ratio, respectively. *SIZE* is measured as the natural logarithm of total assets. *EUROSTOXX* is as an indicator of the state of general equity markets. *ITRAXX* is included as the indicator for banks' bonds. *SOVEREIGN* is the risk-free rate in each country. *SWAPSP* is the difference between the mid-5-year IRS and the reference for a euro 5-year sovereign bond. *GDP* is the quarterly growth rate of GDP. *MKTSHARE5* is the bank concentration ratio, measured as the share of total assets held by the five largest banks in each country. *NPLsys* and *ROAsys* denote the NPL ratio and the ROA, respectively, of the banking sector in each country. Country and time fixed effects are included, although their coefficients are not reported. Standard errors appear in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

	(1) A1	(2) A2	(3) Baa1	(4) Baa2	(5) Baa3	(6) Ba1
MATURITY	0.930*	0.390***	0.531***	0.736***	0.681***	1.198**
	(0.391)	(0.065)	(0.182)	(0.178)	(0.126)	(0.429)
BIDASK	–3.700	–0.917	–0.613	–0.763	0.339	–5.067**
	(6.950)	(0.699)	(3.132)	(3.386)	(2.154)	(2.025)
NIM	–3.442	0.088	–0.281**	0.597**	0.447	–0.392
	(2.893)	(0.054)	(0.140)	(0.237)	(0.348)	(0.633)
COST	–0.791	0.021	0.008	–0.105	0.190	0.018
	(1.354)	(0.194)	(0.171)	(0.189)	(0.239)	(0.230)
NPLR	0.029	0.057	–0.171	–0.531**	0.199	–0.097
	(3.088)	(0.108)	(0.310)	(0.236)	(0.183)	(0.203)
EQUITY	–1.923	–0.285	–0.069	–0.022	0.465*	0.071
	(1.733)	(0.281)	(0.237)	(0.333)	(0.256)	(0.208)
DEPOSITS	4.174	0.219	0.408*	0.028	0.049	0.415
	(2.338)	(0.170)	(0.204)	(0.169)	(0.362)	(0.473)
SIZE	–1.126	–0.485**	0.167	0.032	0.343*	–0.012
	(1.339)	(0.230)	(0.134)	(0.139)	(0.197)	(0.292)
EUROSTOXX	0.485	–0.118	0.170	–0.099	0.075	–0.212
	(0.736)	(0.084)	(0.244)	(0.241)	(0.373)	(0.485)
ITRAXX	0.353	–0.046	0.404*	0.063	0.756**	–0.165
	(0.669)	(0.072)	(0.209)	(0.134)	(0.362)	(0.364)
SWAPSP	0.783	–0.329**	–0.014	–0.489***	–0.243	–0.493
	(1.428)	(0.126)	(0.188)	(0.179)	(0.343)	(0.336)
SOVEREIGN	–0.282	0.130	0.281*	0.413***	–0.021	–0.269
	(0.727)	(0.089)	(0.156)	(0.132)	(0.212)	(0.495)
GDP	–1.102	–0.118*	–0.214	–0.008	–0.319	–0.180
	(1.644)	(0.062)	(0.137)	(0.109)	(0.220)	(0.434)
MKTSHARE5	1.632	0.518*	0.005	–0.005	–0.263	–1.313***
	(5.199)	(0.252)	(0.136)	(0.163)	(0.383)	(0.442)
NPLsys	7.248	–0.262	–0.621	–3.401***	–1.937	0.083
	(11.900)	(0.816)	(0.712)	(1.275)	(1.309)	(0.136)
ROAsys	–0.202	0.539	0.161	–0.006	0.314	0.458
	(1.197)	(0.402)	(0.140)	(0.148)	(0.257)	(0.753)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23	43	78	102	54	33
R-squared	0.945	0.862	0.407	0.479	0.713	0.809

6. Conclusions

In this paper, we have examined the determinants of MREL-eligible debt yields. In particular, we have focused on the roles played by issuance- and bank-level characteristics, as well as by the specific features of the market and banking system in which the financial entity operates. Over a sample of 63 European banking groups and 380 issuances launched during the period 2009Q3–2019Q2 in 14 European countries, our basic set of results confirm that the cost of MREL-eligible debt products is risk sensitive, as investors closely monitor indicators related to individual banks, issuances, markets and the banking system potentially affecting MREL-eligible debt default risk.

We find evidence of risk sensitiveness of MREL-eligible debt in relation to the bank-level characteristics of profitability, asset quality, capital, business model and size. Moreover, market variables also appear to be significant factors explaining the cost of funding of MREL debt. Specifically, the fact that higher sovereign yields entail higher MREL-eligible debt costs could be seen as an evidence of the bank–sovereign nexus remaining important in the European banking sector, although the project of the Banking Union is at a very advanced stage. Our empirical findings allow us to demonstrate the importance of banking sector characteristics as debt cost determinants. According to our evidence, both the level of profitability and the soundness of the banking sector, as well as the structure of the banking market in terms of concentration ratios, are explanatory factors for MREL debt costs.

A more in-depth analysis of our basic empirical findings allows us to confirm that these results present high levels of heterogeneity. In particular, we find evidence of enhanced risk sensitiveness for O-SIIs and non-systemic banks. We also examined if the determinants of MREL debt costs vary across time depending on two main factors: (i) the entry into force of the BRRD I and (ii) the implementation of unconventional monetary policies through the TLTRO programmes. We have identified higher levels of risk sensitiveness after the entry into force of BRRD I. During TLTRO periods, however, we observed less risk sensitiveness, in particular regarding bank and market risk variables. When we examined the extent to which the specific type of debt product shapes the risk sensitiveness of the examined variables, our results suggested that investors closely monitor senior non-preferred issuers, which means that the market discipline that has traditionally been exercised through subordinated debt is currently exercised through senior non-preferred debt. Bank credit ratings also appear to be an important, high-credibility tool that helps investors to monitor risky issuers.

The results of our paper may have important implications for bank managers and policymakers. First, they highlight the specific bank-level characteristics that the managerial team of the bank should pay special attention to in order to reduce the cost of the issued debt products. Second, it is also important for the team to recognise the relevance of market conditions and the specific features of the banking sector, both in terms of soundness and market structure. Third, the evidence presented in this paper indicates that senior non-preferred debt could function as an additional tool to be used by supervisors and policymakers to monitor banks. In particular, in aggregate terms, the performance of senior non-preferred debt could be a useful indicator of the stability of the banking system.

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